U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject:	Action: Review and Concurrence, Equivalent Level of Safety Finding for the Embraer Model ERJ-170 FAA Project Number TC0056IB-T	Date:	October 8, 2003
		Reg Ref:	§§ 25.1389(b), 25.1391, 25.1393, 25.1395
From:	Manager, TSS Airplane and Flight Crew Interface Branch, ANM-111	Reply to Attn of:	Greg Dunn ANM-115
To:	Manager, International Branch, ANM-116	ELOS Memo #:	TC0056IB-T-S-34

Background

It has been established that the forward position lights of the Embraer ERJ-170 airplane, whose type design includes blended winglets:

(1) do not strictly meet the intensity requirements specified by RBHA/FAR/JAR 25.1389(b)(1), 25.1389(b)(2), 25.1391 and 25.1393; and

(2) exceed the allowable overlapping intensities specified by RBHA/FAR/JAR 25.1389(b)(3) and 25.1395.

Embraer consequently requested an Equivalent Safety Finding (ESF) for the above referenced requirements.

Applicable regulation(s)
§ 25.1389(b), 25.1391, 25.1393, 25.1395

Regulation(s) requiring an ELOS
§ 25.1389(b), 25.1391, 25.1393, 25.1395

Description of compensating design features or alternative standards that allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

Minimum Intensity Level
The forward position light installation (both left and right) does not meet the minimum required intensity levels of FAR 25.1389(b)(2) near the dihedral limit for the forward lights (110 degrees) over a very narrow vertical azimuth angle. The area where the minimum intensity requirement is not met is five degrees in dihedral (105 to 110 degrees measured from straight ahead) and five degrees in vertical angle (between approximately five and ten degrees above horizontal). The critical vertical angle varies slightly between the left and right hand installation and between the forward and aft light (the position light installation has two separate lights for dispatch

redundancy), but the total coverage area where the minimum intensity is not met is about 0.03 steriradians, which is only about 0.6 percent of the required coverage area.

Intensities in Overlap Areas

For the areas where the green and red lights overlap, at all dihedral angles the position light installation of the ERJ 170 maintains positive overlap intensity margin, i.e., the main beam signal is always greater than the overlapping signal for all vertical angles between +/- 42 degrees. At vertical angles less than +/- 30 degrees where FAR 25.1395 requires a positive signal margin, the smallest positive margin where the overlap measurement exceeds the 25.1395 limit is 83 candelas for the red-green overlap area, and 40 candelas for the red-white overlap area. The green-white overlap area never exceeded the FAR 25.1395 limit within the +/- 30 degree limit. These signal intensity margins are significantly higher than the basic intensity requirements of 25.1389 and ensure that the main beam color will always be easily perceived.

Any signal margin less than these high values are outside the +/- 30 vertical angle limit where negative margins are allowed by the regulations. In addition, the coverage areas where the maximum overlap limit is exceeded are limited to narrow angles, with all overlap exceedances except one less than 20 degrees in vertical size and none more than 30 degrees.

The only place where the signal ratio reverses is at very high vertical angles greater than 40 degrees where reversals are allowed and where the target airplane would not likely be visible to the other flight crew due to visibility obstructions by cockpit structure.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

Minimum Intensity Level

The lower level of intensity over only 0.6 percent of the required coverage area for the forward position lights is more than compensated by the general high level of intensity provided over the entire coverage area. Accordingly, the ERJ 170 position light installation provides a significantly greater level of visual conspicuity than that required by FAR 25.1389(b)(1) and (b)(2), 25.1391, and 25.1393, and hence provides the basis for a finding of equivalent level of safety for those regulations.

Intensities in Overlap Areas

The position light installation of the ERJ 170 does not meet the maximum overlap intensity levels of FAR 25.1395 but the intensity levels provided by the halogen lights provide an intensity level in the main beams that are much greater than the minimums required by FAR 25.1391. This high intensity of light provided in the required coverage areas more than compensates for the small intensity exceedances in the overlap areas. While the position light installation does not literally comply with FAR 25.1395 limits, the intensities supply a greater level of safety than that required by the regulation, and hence provide a basis for a finding of equivalent safety.

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned Equivalent Level of Safety Finding as documented in Issue Paper S-34. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet

under the Certification Basis section. [E.g. Equivalent Safety Findings have been made for the following regulation(s):

§§ 25.1389(b), 25.1391, 25.1393, 25.1395 Position Light Intensities (documented in TAD ELOS Memo TC00561B-T-S-34)]

Manager, TSS, Airplane and Flight Crew Interface Branch, ANM-111	Date

ELOS Originated by: Standards Staff, Airplane and Flight Crew Interface Branch	Project Engineer Greg Dunn	Routing Symbol ANM-111